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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Karla Moore

Docket: SACHER II-Div

Applicant(s): Dr. Joachim Sacher
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In Response to Paper No.: 1203
Art Unit: 1763

Title: COATING PROCESS AND APPARATUS

Commissioner for Patents
Alexandria, VA 22313-1450
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April 27, 2004

SIR:

APPEAL BRIEF

This is an appeal from the Examiner's Final Rejection dated 12/15/03 of claims 14 – 20 of the present application.

1) REAL PARTY IN INTEREST

The real party in interest is the party named in the caption of the brief.

2) RELATED APPEALS AND INTERFERENCES

There are no related appeals and interferences which would directly affect, or have a bearing on, the Boards decision in the pending appeal.

3) STATUS OF THE CLAIMS

Claimd 14 – 20 are pending in the application. Claims 14 – 16 and 18 – 20 stand rejected under 35 USC 103(a) as being unpatentable over US patent No. 6 037 006 to Chakrabarti et al. in view of US patent No. 5 221 636 to Landreau et al. and claim 17 stand rejected under USC 103(a) as being unpatentable over Chakrabarti et al., Landreau et al. and Kawarada et al. as applied to claims 14 – 16 and 18 – 20 and further in view of US patent 5 980 975 to Nomura et al.

4) STATUS OF AMENDMENTS FILED AFTER FINAL REJECTION

There are no amendments after final rejection.

5) SUMMARY OF THE INVENTION

The present invention resides in an apparatus for coating the facets of semiconductor diodes with an antireflection layer of minimal reflectivity. The apparatus includes means for monitoring, in situ, that is during the coating procedure, at least one of the laser parameters of each laser diode. A receiver is provided for containing the laser diodes that is supporting them on a support structure such that their facets are all disposed at essentially the same distance from a coating source and, for each laser, an individual shutter is supported on the receiver so as to be movable selectively in front of the laser diode to protect the respective laser diode from further coating when the laser parameters indicate that an optimum coating stage has been reached for a particular laser diode (laser).

In short: When the monitoring means by which the lasers which are all subjected at the same time to the same coating process indicates that one of the individually monitored lasers has reached optimum coating thickness, its individually operable shutter is activated so as to cover the particular laser to prevent further coating while the coating process for the other lasers continues.

It is noted that, with the apparatus according to the invention, a relatively large number of lasers can be coated at the same time while the coating process can be adjusted individually for each laser that is it can be terminated for any laser when the optimum coating thickness has been reached for a particular laser while the coating process for the other lasers continues.

6) CONCISE STATEMENT OF THE ISSUES FOR REVIEW

The board is to review whether claims 14 -16 and 18 – 20 are unpatentable over US patent No. 6 037 006 to Chakrabarti et al., in view of US Patent No. 5 221 636 to Landreau et al. in view of Japanese Patent No. 61 204 373A to Kawarada et al., and whether claim 17 is unpatentable over Chakrabartie et al., Landreau et al. and Kawarada et al. as applies to claims 14 – 16 and 18 – 20 and further in view of US Patent No. 5 980 975 to Nomura et al.

7) GROUPING OF CLAIMS

There is only one group of claims, that is, independent claim 14 and claims 15 – 20 dependent on claim 14. The dependent claims are directed to specific features which are considered to be particularly advantageous in connection with the invention as defined in the independent claim 14.

8) ARGUMENTS

a) The prior art on which the rejections are based

1. Chakrabarti et al. (US 6 037 006) discloses a method and apparatus for the coating of facets of diode laser bars. The apparatus comprises a vacuum chamber 160 in which an electron beam source 168 is disposed for vaporizing coating material. A rotatable structure 164 is supported at the top of the chamber and carries a number of fixtures 150 supporting diode laser bars 90, which are engaged between web slots 50-1 to 50-n. The web slots are spring-biased toward each other and hold the diode laser bars therebetween while protecting their side surfaces from being coated. The fixtures 20 may be rotated for coating the front facets 100 and the rear facets 102 of the diode laser bars 20.

The vapor source 170 is arranged at one side of the vacuum chamber 160 so that, by rotating the rotatable structure 164, successively, one fixture 150 after another is exposed to the coating vapor 176 for the coating of the facets of the laser bars supported by the fixtures.

The purpose of this apparatus is to provide a cost-effective method of facet coating for diode laser bars. To this end, each fixture 150 supports a plurality of lasers which are all coated at the same time and the fixture can be rotated in order to coat different surfaces of the lasers without having to open the chamber and re-arrange the lasers. However, while the apparatus provides for an efficient coating process by coating a relatively large number of

lasers at the same time, an accurately controlled thickness for each individual laser cannot be provided by this method.

2. Landreau et al. (US 5 221 636) discloses a process and apparatus for the deposition of an antireflection coating on the facets of an optical amplifier (laser). A particular laser is subjected to the coating procedure until the coating has reached the desired thickness which is determined by monitoring a voltage. The two facets of a laser are alternatively treated so that the coating is applied essentially simultaneously and symmetrically. The thickness of the coating is measured by applying a current to the optical amplifier or laser being treated and shutting down the coating procedure when the voltage across the optical amplifier passes through a maximum which indicates that an overall reflectivity minimum has been reached.

With this method, a laser is individually coated while the coating thickness is being measured. The process is very time consuming and expensive since, at any time, only a simgle laser is installed and treated in the apparatus.

3. Kawarada et al. (JP 61 204 373) discloses an apparatus and method of providing substrates with coatings of different thicknesses in a single coating procedure.

Kawarada et al. explains that in a coating procedure, wherein all the substrates are subjected at the same time to the vapor deposition process, the substrates will all have the same coating thickness at a particular time during the procedure. Kawarada et al. therefore provides shutters for individually covering selected substrates after a certain exposure to the coating process while the coating procedure for the other continues so that substrates with different coating thicknesses can be obtained in a single vapor deposition procedure.

4. Nomura et al. (US 5 980 975) discloses a method and apparatus for manufacturing large thin-film coated substrates, such as antireflection filters, by measuring the coating formation on the substrate using a film formation monitor or monitors placed outside the film formation area and measuring the thickness of the coating on the monitors, and controlling the film coating process based on the measured thickness of the coating deposited on the monitors.

b) <u>The Examiner's Rejection</u>

In her rejection of claims 14 – 16 and 18 – 20, the Examiner states that it would have been obvious to one of ordinary skill in the art at the time the Applicants' invention was

made to have provided in situ monitoring of at least one of the laser parameters in order to determine an overall reflectivity minimum of a coating applied and thus providing a stopping point for the coating process as taught by Landreau et al.

c) Applicant's Position

In Chakrabarti et al., no monitoring is provided for the lasers while they are being coated.

The Examiner states that Landreau teaches the monitoring of a laser parameter (i.e. the electric voltage) of at least one of the lasers while at least one laser is electrically operated, and that Kawarada et al. teaches the use of a plurality of shutters for the purpose of simultaneously forming plural substrates with different film thicknesses in one film forming stage while enabling independent masking of each of the substrates. However although it can be said that a laser parameter is monitored, the laser is not operated. Rather a voltage is applied across the film being deposited and the resistance is measured to determine the thickness of the film being deposited.

The Examiner also states that it would have been obvious in view of Kawarada et al. to provide individual shutters in order to form substrates with different film thicknesses in a film forming stage and also to enable independent masking of each of the plural substrates.

In Landreau et al., what is desired for the lasers is to provide a certain different coating thickness which is pre-selected. The coating of a laser is discontinued when such thickness has been reached. The coating thickness is measured by measuring the voltage across the coating. No operating parameters of the laser are monitored. Those may not be in any accurate relationship with the coating thickness. And it is not the exact thickness of the coating what is important for optimum operation of the laser, but it is the optimum operation of the laser what counts.

Besides, in Landreau, only a single laser is treated at a time so that the procedure can be discontinued at any time without consideration for other lasers.

And Kawarada et al discloses a method of applying different coating thicknesses to different lasers in the same procedure by covering lasers when a desired predetermined coating has been applied. In this case, the desired coating thickness is known and when this thickness is reached, the coating process is interrupted.

It is pointed out that laser parameters are considered to be operating parameters of a laser. It is noted in the description that "as laser parameters, the energy or the quantum efficiency of the light emitted by the laser can be used. Selectively also, the wavelength, the electric voltage at the p-n junction of the laser or its current threshold can be used as laser parameters (page 14, lines 19 – 24), that is, the lasers must be operated while they are being coated and the optimum coating thickness is determined from a optimum operation of the laser, not from a measured thickness which is assumed to provide optimum operation possibly on the basis of prior experience.

The concept pointed out above is not disclosed in any of the cited reference nor is there any hint that a number of lasers are concurrently coated while the lasers are operated to provide operational parameter values and an individual laser is covered by a shutter when it is determined from the parameter value of the operated laser, that an optimum coating value has been reached, while the other lasers which have not yet reached that stage are still subjected to the coating procedure.

In summary:

In Chakrabarti et al., a plurality of lasers is coated concurrently. No individual control for the lasers mounted on a fixture is provided for or is possible.

In Landreau et al., a single laser is arranged in a coating chamber such that the coating procedure can be discontinued when an optimal coating stage has been reached for the single laser in the coating chamber.

In Kawarada et al., substrates with different coating thicknesses can be produced in one procedure. The desired coating thicknesses of the various substrates is known and the respective lasers are covered when the desired coating thickness of a particular substrate has been reached. There is no reference to lasers. The document is concerned with the holder for the substrates.

In Nomura et al., substrates such as antireflection filters are coated with an anti-reflection film, while the film formation is monitored by an outside measuring device. No shutters for individually terminating the coating procedure are provided.

Would a combination of the teachings of these references lead to the apparatus according to the invention, wherein a plurality of lasers are arranged essentially equidistantly from a coating source so that they are coated essentially at the same rate but at the same time

are all operated and individually monitored for optimum coating and individually covered by shutters when the coating of the individual lasers is found optimal? It is pointed out that this procedure provides for a rapid concurrent coating of a plurality of lasers with high accuracy and few rejects.

None of the references suggests that a plurality of lasers are operated and monitored, individually while being coated concurrently and that each laser is covered individually by a shutter when optimum laser operation has been reached.

It is consequently asserted that a combination of the cited references would not lead to the present invention. Neither is the desirability of an arrangement as defined in claim 14 suggested by the cited references.

In this connection reference is made to the following decisions:

" Contrary to the position taken by the Examiner in determining the patentability of an invention, it should be recognized that the fact that the prior art could be modified in an Examiner's view so as to result in the combination defined by the claims at bar would not have made the modification obvious unless the prior art suggests the desirability of the modification." See In re Deminski, 796 F.2d 436, 230 USPQ 313 (Fed. Cir. 1986).

Furthermore, In re Laskowski, CAFC, No. 88-1349, decided April 3, 1989, concerning an invention utilizing, for the support of a saw band, a loose tire rather than a tightly fitted tire, the Court stated that, although the Commissioner suggests that Hoffman (the cited prior art utilizing a tightly fitted tire) could readily be modified to form the Laskowski structure (with loosely fitted tire), the mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification.

Concerning the Examiner's allegation that "it would have been obvious to one of ordinary skill in the art at the time, the Applicants' invention was made to have provided individual shutters for plural substrates in the prior art in order to simultaneously form plural substrates with different film thicknesses in one film forming stage and also to enable independent masking control each of the plural substrates as taught by Kawarada et al.", it is pointed out that in Kawarada et al., a predetermined different film thicknesses are to be applied to a substrate which is done by masking the substrates after a certain time of exposure to the deposition procedure. No suggestion can be derived from Kawarada et al. that all of

the substrates could or should be operated in some way to determine the point in time when the shutters should be activated. The masking control is presumed to be time-based. Actually, Kawarada et al. is mainly concerned with the mechanism for operating the shutters and not with the concept of determining an optimum thickness for the coating of individual substrate or lasers during the coating procedure in which a plurality of lasers are concurrently coated.

In view of the above arguments, it is believed that the Board will agree that the apparatus as defined in claim 14 is not obvious from the references cited by the Examiner.

Claims 15 – 17 relate to particular support arrangements for the laser diodes which provide for relatively uniform vapor deposition on the laser diode facets and claims 18 to 20 relate to various laser parameter monitoring and control arrangements. These features are considered to be advantageous in connection with the apparatus as defined in claim 14. They should be considered patentable in connection with claim 14.

SUMMARY

The present invention fulfills all the requirements for patentability:

1.The invention is novel. This is not questioned by the Examiner.

2. The invention is unobvious as none of the cited references discloses or suggests an arrangement as defined in claim 14.

3. The invention is useful as it permits the concurrent rapid coating of laser diodes to an individually optimized degree.

The Board is consequently respectfully requested to reverse the Examiner's final rejection of claims 14 - 20 and to direct the Examiner to allow these claims.

Respectfully submitted,

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APPENDIX

Claims

14. An apparatus for coating at least one of the front and rear facets of semiconductor laser diodes, lasers, with an anti-reflection layer of minimal rest reflectivity, said apparatus including means for monitoring, in-situ, at least one of laser parameters of each laser, including laser light emitted from at least one of the front and rear facets of each laser, the electric voltage at a p-n junction of the laser, the quantum efficiency of the laser light emitted from at least one of the front and rear facet of the laser, and the threshold current of the laser, said apparatus comprising a receiver for containing lasers to be coated, a coating source disposed in said receiver, a support structure for supporting said lasers to be coated such that said lasers are supported with their facets all at essentially the same distance from said coating source, and for each laser ~~a~~ an individual shutter supported in said receiver so as to be movable selectively in front of said lasers to protect them from further coating when the laser parameters indicate that an optimum coating stage has been reached for a particular laser.

15. An apparatus according to claim 14, wherein said lasers are supported on a support structure forming a magazine by which they can be moved into, and out of, said receiver.

16. An apparatus according to claim 14, wherein said lasers are arranged in a circle around said coating source.

17. An apparatus according to claim 14, wherein said lasers are arranged linearly along lines disposed at opposite sides equidistantly from a center line.

18. An apparatus according to claim 14, wherein a control unit is provided which monitors the laser parameter of said lasers disposed in said receiver for the coating thickness of their facets while each laser is electrically operated.

19. An apparatus according to claim 18, wherein said control unit includes at least one of a laser control, a shutter control, a layer thickness and a vacuum control arrangement.

20. An apparatus according to claim 19, wherein said control unit is in communication with said coating source, said laser support and said shutter by at least one of electrical and optical conduits.